# United States Patent [19]

**Palazzola**

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[54] **CAMLESS GRINDER**


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[51] **Int. Cl.**[5] ..... **B24B 3/20**

[52] **U.S. Cl.** ..... **51/5 D;** 51/95 R; 51/98.5; 51/325

[58] **Field of Search** ..... 15/97 B, 53 AB; 51/217 R, 5 D, 207, 93, 95 R, 75 WH, 103 R, 93, 98.5, 105 EC, 92 ND, 325



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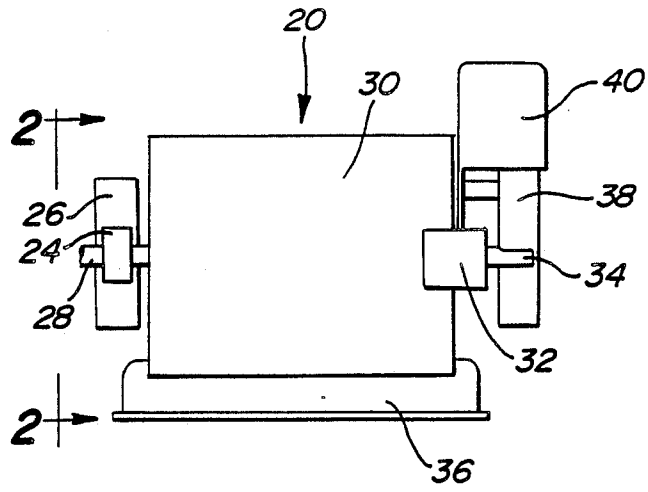
[57] **ABSTRACT**

A method and apparatus has been disclosed for grinding contour punch parts. The apparatus is capable of movement on six axes. The main features of the invention include stopping rotation of the part when a flat surface is desired to be ground on the part and moving it directly vertically upwardly with respect to the grinding wheel, thus forming a smooth flat surface on the part. The part is moved on three axes, laterally, horizontally and vertically with respect to the grinding wheel. In addition, a dressing apparatus, movable on two axes, is disposed behind the grinding wheel and maintains a desired surface upon the grinding wheel. The dressing surface may form a ramp surface on the grinding wheel that will create a ramp surface on the finished part.


**19 Claims, 3 Drawing Sheets**



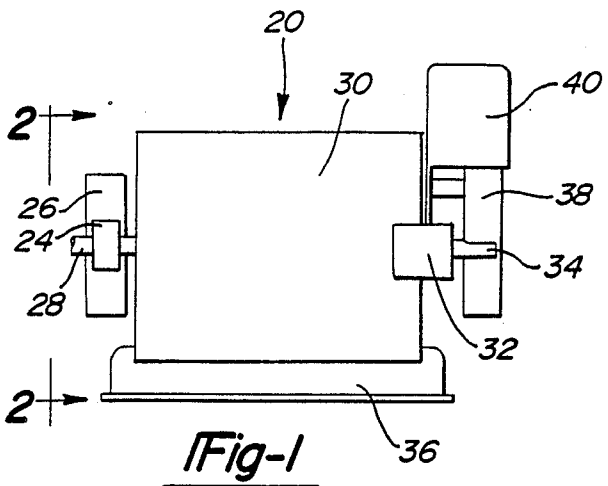



Fig-1

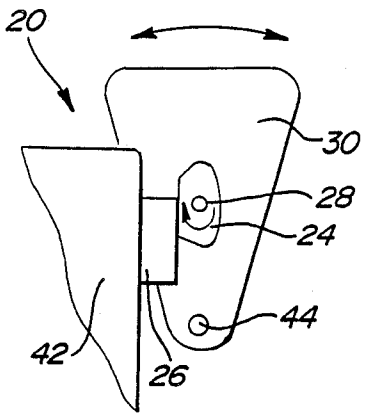



Fig-2

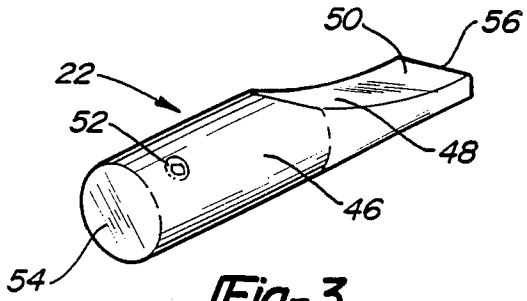



Fig-3

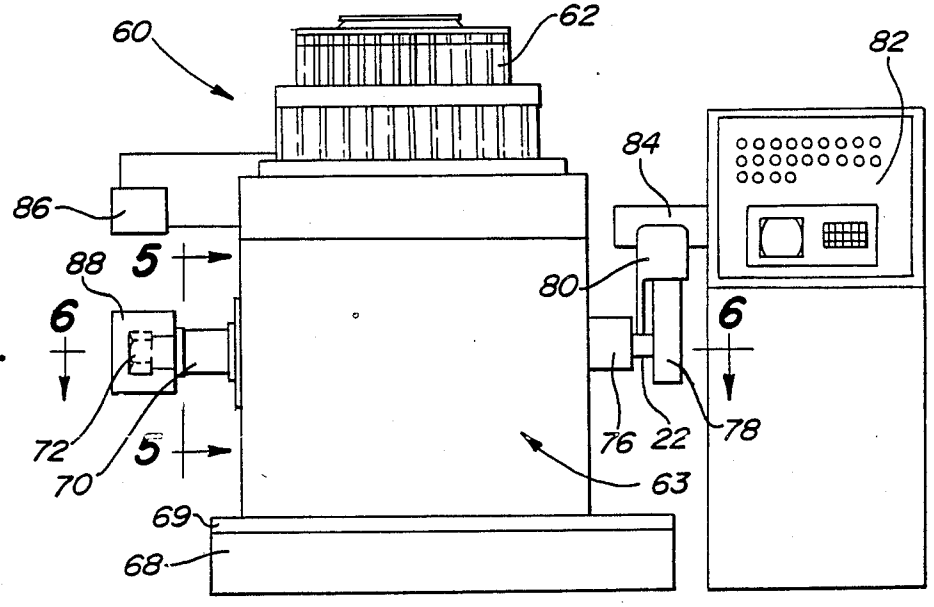



Fig-4

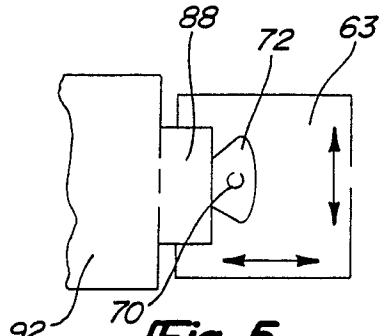



Fig-5

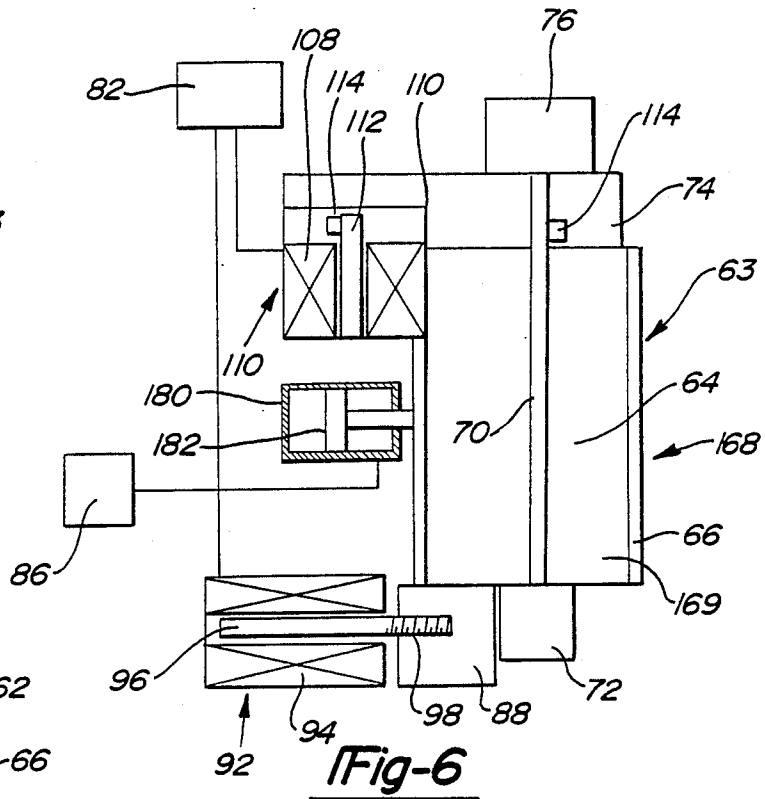



Fig-6

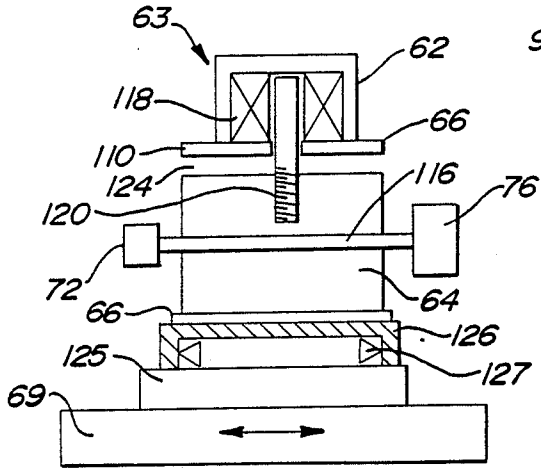



Fig-7

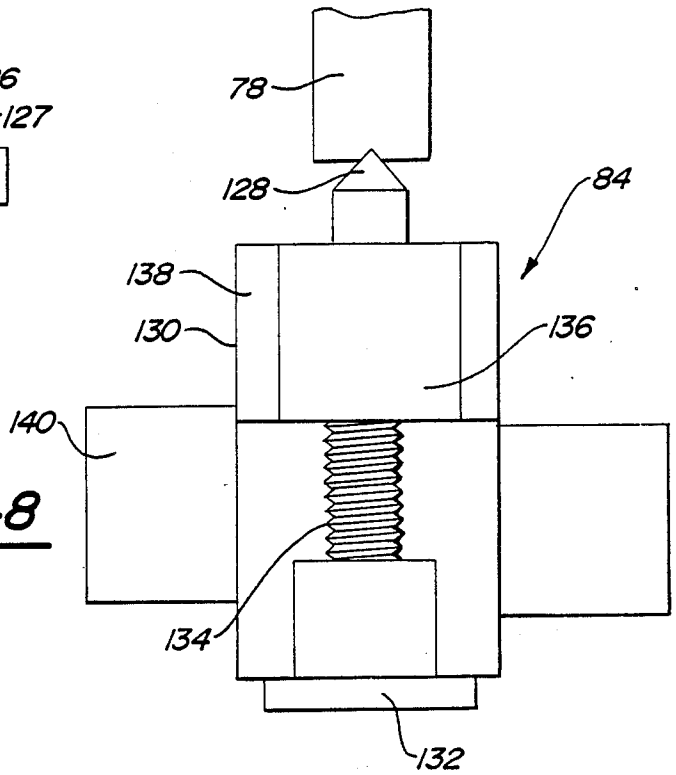



Fig-8

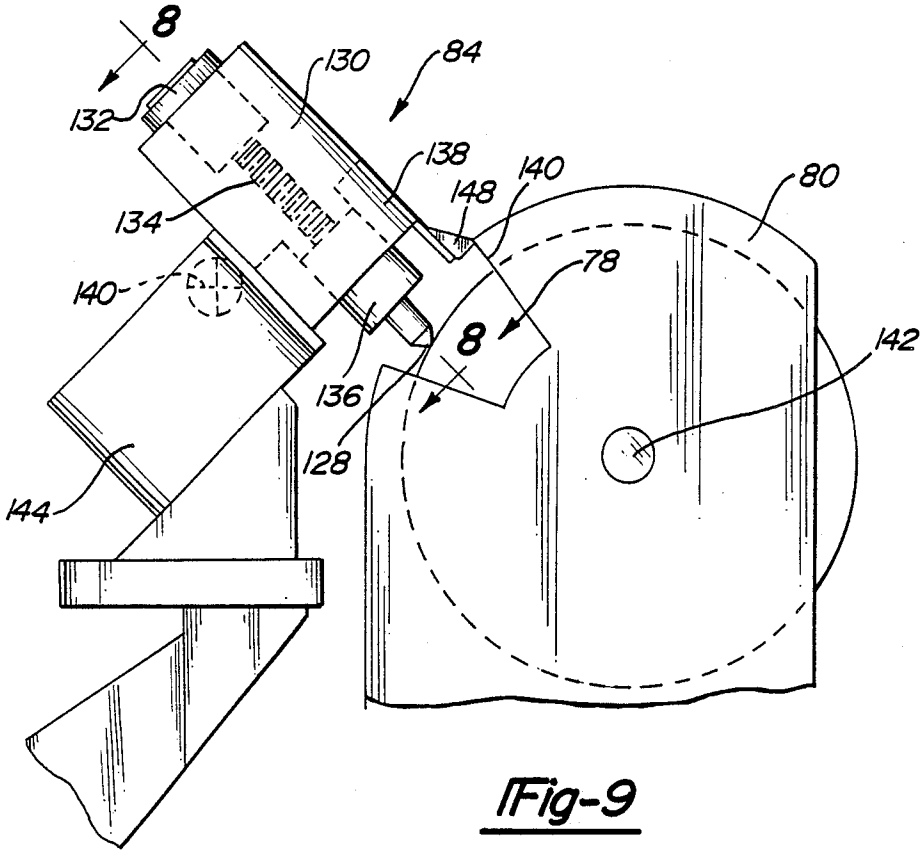

8
130
84
132
138
140
148
80
134
78
140
8
142
136
128
144

Fig-9

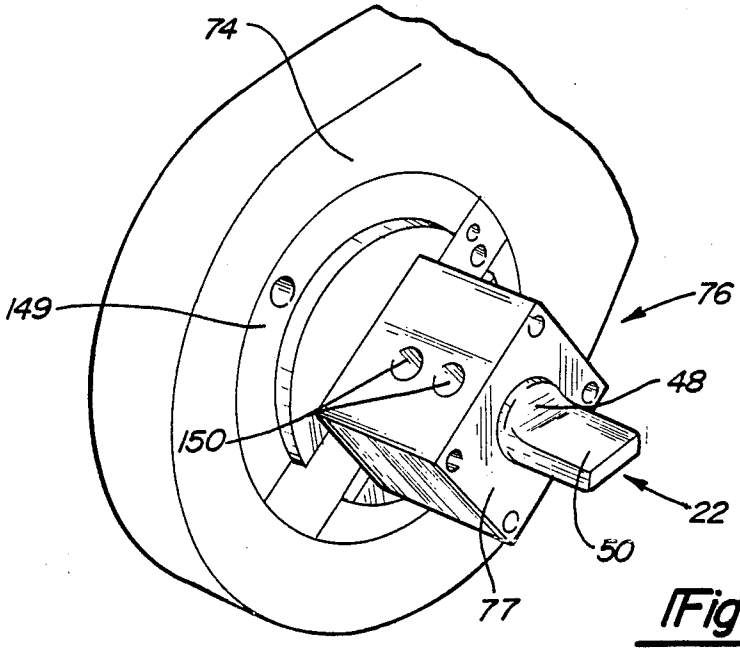

74
149
76
48
150
22
50
77

Fig-10

# CAMLESS GRINDER

## BACKGROUND OF THE INVENTION

This invention in general relates to grinding machines. In particular, the invention relates to an improved contour punch grinder for use in grinding metal punches.

Metal punches are utilized to punch apertures into sheet metal. The prior art machines for grinding a metal punch would pivot a metal blank into and away from the grinding wheel in order to shape the proper surface on the blank. A prior art grinding apparatus is shown in FIGS. **1** and **2**. Prior art grinding apparatus **20** includes a cam **24** and a cam surface **26**. Cam **24** was mounted upon a shaft **28** that rotated integrally with part holder **32**. A motor rotates shaft **28**, cam **24** and part holder **32**. Shaft **28** and part holder **32** were mounted within main body **30**, and part holder **32** had a part **34** to be ground mounted therein. As shown in FIG. **1**, main body **30** is mounted to fixed base **36**. Grinding wheel **38** and grinding wheel cover **40** are shown horizontally aligned with part **34**.

As shown in FIG. **2**, cam **24** will rotate against cam surface **26** which is fixed to stationary surface **42**. Main body part **30** is pivotally mounted to base **36** as shown by pin **44**. Main body **30** is weight-biased to pivot into the wheel and thus cam **24** is biased into surface **26**. However, the cam shape will cause the cam **24** and main body **30** to pivot against this bias whenever a relatively large diameter portion of the cam is in contact with the cam surface. Cam **24** would rotate along cam surface **26** and cause main body **30** to pivot clockwise and counterclockwise about pin **44**. Part holder **32** and part **34** would be moved therewith into and away from grinding wheel **38**. Thus, by properly shaping cam **24**, a desired surface can be formed upon contour punch part **22**.

This type of prior art device was unsatisfactory since a cam needed to be manufactured for any run of contour punches that was to be manufactured. This is not particularly expensive if a large number, say thousands or hundreds of thousands, of the contour punches were to be manufactured; however, if only a small number of punches were to be manufactured it would be unduly expensive to create a cam such as shown at **24**.

One prior art device attempted to solve this problem by computerizing a motor to pivot main body part **30** into and away from grinding wheel **38**. This was also unsatisfactory since the computer program was extremely complicated and required the introduction of several variables.

A contour punch as is commonly found in industry is shown in FIG. **3**. This punch consists of a main body portion **46** that may sometimes have a ramp portion **48** extending between main body portion **46** and a flat planar surface **50**. A lock nut indentation **52** is formed near one end **54**, the planar surface **50** being formed at the other end **56**. In contour punch **22**, surfaces **48** and **50** have been formed by a grinding wheel while main portion **46** is relatively unground and retains its original shape. When utilizing a prior art grinder that pivoted, a flat planar surface, such as shown at **50**, will have wavy surfaces. The prior art grinding wheels were not capable of grinding a completely flat surface by merely pivoting into and away from the grinding wheel.

It is therefore an object of the present invention to create a grinding apparatus that will allow the use of either a cam or a computer control to control the movement of the contour punch part holder into and away from the grinding wheel.



It is further an object of the present invention to create a contour punch grinder apparatus that will grind a perfectly flat surface when one is desired upon a particular contour punch.

Moreover, it is an object of the present invention to achieve these goals with an apparatus that is relatively simple and economical.

## SUMMARY OF THE INVENTION

The present invention discloses a contour punch grinder that utilizes movement upon six different axes to ensure that the final contour punch will have a desire surface.

The contour punch grinder of the present invention achieves these goals by having a main body portion that is guided for movement along all three dimensions. That is, the main body may be moved directly vertically, horizontally, and laterally. In addition, a contour punch part holder is rotatably mounted within the main body and is driven by a rotating motor.

Thus, when it is desired to grind a particular surface on a contour punch, the main body is brought horizontally into alignment with a grinding wheel and then moved laterally into contact with the grinding wheel. The part is held in contact with the grinding wheel, and it is rotated to create any curved surfaces that may be desired on the contour punch. The movement of the main body and the contour punch part holder may be controlled by a cam, or it may be computer controlled. If a cam is used, some computer control is envisioned for driving the various motors.

When it is desired to create a flat surface upon a particular contour punch the part holder is first prevented from rotating and maintained in a static position. The part is then brought into contact with the grinding wheel, and the vertical movement motor of the main body of the contour punch grinder apparatus is activated to move the entire body of the contour punch grinder vertically upwardly or downwardly. This will bring the associated contour punch part holder and contour punch along therewith. The contour punch is thus caused to move vertically along the grinding wheel while not rotating. Due to this movement, an entirely flat surface will be created on the contour punch. Although vertical movement is preferably used to create the flat surface, horizontal movement may also be acceptable.

The main body of the contour punch grinder apparatus has a first motor for lateral movement with respect to the grinding wheel, a second motor for horizontal movement with respect to the grinding wheel, and a third motor for vertical movement with respect to the grinding wheel.

An additional feature of the invention consists of having a high-pressure gas jet applied against the main body to bias it into contact with a laterally furthermost position in the direction of the grinding wheel. In the event that the part or grinding wheel seizes and an overly large force is applied to the body, the body will move away from the wheel and against the force of the high-pressure jet and relieve the seizure of the part or wheel.

A further aspect of the present invention is a dresser apparatus for accurately maintaining the desired surface

on the grinding wheel. The dresser apparatus of the present invention consists of a diamond-tipped dresser member that is brought into and out of contact with a rear portion of the grinding wheel. The dresser member is moved into contact with the wheel in order to grind off a surface of the wheel. A second motor moves the dresser apparatus laterally along the wheel. By entering the desired surface of the grinding wheel into the computer control, the control will then position the diamond-tipped dresser member against the grinding wheel to form any ramps or the like that may be desired upon the grinding wheel and the final contour punch.

The method of the present invention consists of horizontally and laterally aligning the part with the grinding wheel and controlling the movement of the various motors on the main body part to grind down the contour punch part to a rough approximation of its final shape. The part is then moved away from the grinding wheel, and the dresser assembly is brought into contact with the wheel in order to accurately shape a desired surface face upon the grinder wheel. Once the dresser assembly has accurately formed the desired face upon the grinder wheel, the part is then brought back into contact with the grinding wheel, and a finished grind is performed. It is to be understood that several increments of this dressing and finish grinding may be performed in order to more accurately shape the finished contour punch to the desired dimensions. Whenever a flat surface is desired upon the contour punch, the rotary motor driving the part holder is stopped, and the part is moved vertically with respect to the grinding wheel. This causes the part to have a finished flat surface that is smooth.

Further objects and features of the present invention can be best understood from the following specification and drawings, of which the following is a brief description thereof.

## BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** shows a side view of a prior art contour punch grinder.

FIG. **2** is an end view along line **2—2** of FIG. **1**.

FIG. **3** shows a contour punch.

FIG. **4** shows a side view of the improved contour punch grinder apparatus of the present invention.

FIG. **5** shows an end view along lines **5—5** of FIG. **4**.

FIG. **6** is a partly schematic cross-sectional view along line **6—6** of FIG. **4** showing the various motors that drive the main portion of the present invention.

FIG. **7** is a partly schematic cross-sectional view.

FIG. **8** is a top view showing the details of the dresser assembly of the present invention.

FIG. **9** is a view perpendicular to that of FIG. **8** showing further details of the dresser assembly of the present invention.

FIG. **10** shows the part holder of the present invention.

## DETAILED DESCRIPTION OF A DISCLOSED EMBODIMENT

This invention discloses an improved contour punch grinder **60** for use in forming contour punches such as shown at **22** in FIG. **3**.

Contour punch grinder **60** consists of a motor **62** for moving a main body **63** vertically upwardly and downwardly with respect to a grinder wheel. Main body **63** is mounted for movement on fixed base **68**. Table **69** moves main body **63** horizontally, as shown in FIG. **4**, with respect to base **68**. Table **69** is driven by a motor, not shown. A cam **72**, similar to the prior art cams, may be utilized with the improved grinder **60**. However, a cam is not necessary. Cam **72** is mounted upon shaft **70** which is in turn mounted to part holder **76**. Part holder **76** holds contour punch part **22**.

Grinder wheel **78** and grinder wheel cover **80** are mounted on a first axis in the vicinity of part **76**. For the purpose of the description included in this disclosure, the direction "laterally with respect to the grinder wheel" refers to movement into and out of the paper as shown in FIG. **4**. The use of the words "vertically" and "horizontally" refers to movement with respect to the grinding wheel as illustrated in FIG. **4**.

A computer control is illustrated at **82** and acts to control the various motors and members of the grinder apparatus **60**. The details of this control are not part of this invention. A worker in the art could assemble an adequate control.

A grinder wheel dresser apparatus **84** is mounted laterally behind grinder wheel cover **80**.

A source of pneumatic pressure **86** is associated with contour punch grinder apparatus **60**.

An abutment **88** serves to move main body **63** laterally, or into an out of the paper as shown in FIG. **4**. As can be seen, abutment **88** is vertically larger than cam **72**.

FIG. **5** is a view similar to that shown in FIG. **2**, but illustrating the movement of the contour punch grinder **60** of the present invention. As can be seen in FIG. **5**, a cam **72** may ride along abutment **88** which is connected to motor **92**. Main body **63** can be seen to be capable of movement in both the lateral and vertical directions. Thus, in the improved contour punch grinder **60** of the present invention, the main body does not pivot; however, it is guided both laterally and vertically. As is also seen from FIG. **5**, cam **72** and shaft **70** are rotatably driven within main body **63**.

A first embodiment is shown largely schematically in FIG. **6**, main body **63** can be moved laterally, vertically, and also horizontally. Main body **63** consists of inner body **64** and outer body **66**. A first motor **92** causes the main body **63** to be moved laterally with respect to the grinding wheel, "laterally" being defined as shown in FIG. **4**.

A first motor **92** consists of a rotary motor **94** with a shaft **96** having the screw thread **98** guided in abutment **88**. Abutment **88** is prevented from rotating and the resulting connection is a rotary to reciprocating connection. The exact motor structure forms no part of the invention and is well known in the art. Thus, when control **82** causes motor **94** to rotate screw thread **98** rotates within abutment **88** and causes abutment **88** to reciprocate laterally. Since abutment **88** is in contact with cam **72** which is in turn mounted within main body **63**, the entire main body is moved laterally by abutment **88**. However, there is no positive mechanical connection between abutment **88** and cam **72**. Thus, abutment **88** only causes cam **72** to move main body **63** away from the grinding wheel. An air cylinder **180** is connected to a pressure air source **86**. Pressure air source **86** sends high-pressure air against a piston **182** which is mounted within chamber **180**. Piston **182** is connected to outer body **66** and thus causes the entire main body **63** to be brought towards the grinding wheel.

When laterally positioning main body **63**, motor **92** causes abutment **88** to abut cam **72** and move body **63** in a direction away from the grinding wheel. Alterna-

tively, when it is desired to move main body **63** towards the grinding wheel, cylinder **180** is sued and piston **182** is biased towards the grinding wheel and brings body **63** along. It is to be understood that when it is desired to move body **63** towards the grinding wheel, abutment **88** is moved laterally towards the grinding wheel also. Thus, cam **72** can move along with main body **63** in the direction of the grinding wheel and will not abut abutment **88**. Should a seizure occur between the wheel and the part, body **63** will be forced against the biased on piston **180** and move away from the grinding wheel.

A motor **110** is mounted to the side of inner body **64** and causes part holder **76** and cam **72** to rotate. Motor **110** consists of a rotary motor **108** that drives a shaft **112**. A belt **114** connects shaft **112** with shaft **70**. A belt guard **74** covers this belt connection. As can be seen, outer housing **66** is cut away in the vicinity of motor **110** to allow motor **110** to be mounted directly to inner body **64**. Alternatively, motor **110** could be mounted to outer body **66** and the tightness of belt **114** would simply vary as part holder **76** is moved vertically.

Rotary motor **62** provides movement of main body **63** in a third direction. As shown in FIG. **7**, a rotary motor **118** is mounted upon outer body portion **66**. A screw thread portion **120** rotates integrally along with rotary motor **118** and is mounted within inner body portion **64**. Since inner body portion **64** is about the same lateral size as outer body portion **66** it is prevented from rotating. Thus, the rotation of threaded surface **120** within inner body portion **64** will cause it to advance vertically both upwardly and downwardly with respect to outer body portion **66**. Basically, outer body **66** surrounds inner body **64** on all but the horizontal sides. Alternatively, there could simply be an opening in outer housing **66** that allows the cam and the part holder to move vertically with respect to the outer housing. Inner body portion **64** is of a smaller vertical dimension than outer body portion **66**. This creates a clearance **124** that allows the inner portion **64** to move within the outer portion **66**. Alternatively, any other type of rotary-to-reciprocating motor may be utilized rather than the one illustrated at **62** in FIG. **7**.

Also shown in FIG. **7** is the mounting of body **63** with respect to moving table **69**. As shown by the arrow, table **69** can move horizontally in either direction and body **63** will move along therewith. A portion **125** of table **69** has a railing **126** slidably mounted thereon. Railing **126** can move laterally with respect to portion **125**. Point bearings **127** are mounted so as to guide railing **126** upon portion **125**. This connection allows main body **63** to be moved laterally with respect to portion **125** and thus table **69**.

FIG. **8** shows a dresser assembly **84** for use in creating a desired surface along grinder wheel **78**. Dresser assembly **84** consists of a diamond-tipped needle **128** mounted within a first housing **130**. Rotary motor **132** having a spiral surface **134**, similar to that disclosed above for motor **62**, is received within part **136**. Part **136** fixedly holds diamond tip **128**. Guide shoulders **138** prevent rotation of part **136** and thus cause part **136** to reciprocate into and out of housing **130**. The reciprocation causes diamond tip **128** to be brought into contact with grinder wheel **78** and may cause diamond tip **128** to be brought radially further into contact with grinder wheel **78**. A second motor **140** causes the entire dresser assembly **84** to move along the surface of grinder wheel **78**. Thus, diamond tip **128** can create a desired surface upon grinder wheel **78** by being moved within housing **130** further into or away from grinder wheel **78** and by being moved horizontally along the surface thereof.

As shown in FIG. **9**, grinder wheel **78** has grinder wheel cover **80** and is rotatably mounted on axis **142**. Dresser assembly **84** consists of diamond tip **128**, outer housing **130**, rotary motor **132**, spiral surface **134**, part **136**, guide shoulders **138**, and second motor **140**. The entire grinder assembly **84** is mounted for movement upon fixed base **144**. The details of the mount between dresser assembly **84** and fixed base **144** are not important to this invention and could be of any type that would allow the movement described above. A further feature of grinder cover **80** is notched portion **146** that allows access to grinder wheel **78** from diamond tip **128**. An alignment notch **148** integral with housing **130** ensures that diamond tip **128** is properly positioned with respect to grinder wheel **78**. That is, notch **146** receives flange **148** to ensure the proper positioning of diamond tip **128**.

FIG. **10** shows the part holder apparatus **76** and part lock member **77**. Part lock member **77** firmly receives part **22**. Ramp **48** and flat portion **50** can be seen to extend beyond part lock member **77**. A central portion **149** will rotate along with belt **114** and includes part lock member **77**. Notches **150** receive Allen screws or the like and align with indent **52** formed in part **22**. The holes **150** and indent **52** ensure proper placement of part **22** within part lock **77**. The part lock connection ensures that part **22** will be accurately positioned with respect to grinding wheel **78** while the grinding operation is in progress.

The grinding operation will now be described with respect to FIGS. **3** to **10**. When a desired contour punch is to be manufactured, the basic desired parameters will be entered into control **82**. The details of control **82** are not important to this invention, and the worker in the art could understand how to achieve the required controls. A part blank to be ground is inserted in part lock **77**, holes **150** and indent **52** ensuring proper alignment. Part lock **77** is then brought into alignment with grinding wheel **78** along with main body **63**. Initial grinding is commenced, and part lock **77** is rotated along grinding wheel **78** to create any curved surfaces that may be desired. The part lock **77** and the associated part **22** are moved laterally and horizontally with respect to grinding wheel **78** while the part lock **77** is being rotated in order to form the desired surface upon part **22**.

If it is desired to have a flat surface, such as shown at **50** in FIG. **3**, formed on the part **22**, the rotary motor **110** is stopped. Rotary motor **62** is energized, inner portion **64**, part lock **77**, and associated part **22** are moved vertically along grinding wheel **78**. This causes a smooth flat surface **50** to be formed upon punch **22**.

If a ramp, such as shown at **48**, is desired, the wheel **78** is initially shaped to form the ramp. This shaping is described below.

Once the rough grinding has been done, the part lock **77** and associated part **22** are moved away from grinding wheel **78**. Dresser assembly **84** is then brought into contact with grinding wheel **78** to accurately form a desired surface upon grinding wheel **78**. If, for instance, a ramp, such as shown at **48** in FIG. **3**, is desired upon the final contour punch, the dresser assembly and the associated diamond tip **128** will be utilized to form the correct surface upon grinding wheel **78**.

In forming a ramp such as shown at **48**, diamond tip **128** would be kept relatively withdrawn into housing **130** at the lefthand side of grinding wheel **78**, as shown

in FIG. 8, and moved out of housing 130 into grinding wheel 78 as it moves to the right along grinding wheel 78. Thus, by moving diamond tip 128 further into grinding wheel 78 as diamond tip 128 moves from left to right along grinding wheel 78, the surface of grinding wheel 78 would have a ramp-like configuration roughly approximating the desired ramp 48 on contour punch 22. It is to be understood that the surface of grinding wheel 78 would be the mirror image of the ramp 48 desired on the part. That is, where the ramp 48 is at its thickest extent near main part 46, the wheel 78 would be at its smallest diameter. At the tail end of ramp 48, near flat surface 50, the grinding wheel 78 will be maintained at a greater diameter. This ramp forming may also be performed prior to any rough grinding.

The dresser assembly 84 may also be utilized simply to ensure the surface of grinder wheel 78 is maintained relatively level along its extent. That is, the rough grinding of part 22 may cause gauges or nicks in the surface of grinding wheel 78 that will be corrected by dresser assembly 84.

Once dresser assembly 84 has accurately formed the desired surface on grinder wheel 78, part 22 is brought back into contact with grinder wheel 78 and the finish grinding is begun. Finish grinding is performed exactly as has been described above with respect to the rough grinding.

It is to be understood that three or four iterations of this dressing and subsequent grinding may be performed in order to achieve a final contour punch.

The teachings of this invention will apply to any type of grinding, and in particular anytime it is desired to grind ramps and flat surfaces.

Preferred embodiments of the present invention have been disclosed; however, they are not intended to limit the scope of the invention. The following claims should be read in order to determine the exact scope of the invention claimed herein.

What is claimed is:

1. A method of grinding a part that may have ramps and flat portions comprising the steps of:

(A) rotating a grinding wheel on a first axis;

(B) rotating a part to be ground on a second axis, the second axis being parallel to the first axis;

(C) bringing the part into contact with the grinding wheel and rotating the part and the grinding wheel to grind material from the part;

(D) controlling the rotation of the part by identifying desired flat portions on the part and stopping rotation of the part when a desired flat portion will be in contact with the grinding wheel; and

(E) moving the part directly vertically upwardly while maintaining it in contact with the rotating grinding wheel and stopping the part from rotating to form a flat surface upon the part.

2. A method as recited in claim 1, and further wherein the grinding wheel is periodically dressed during a grinding operation in order to have a desired surface shaped that will form any ramp portions that may be desired on the part, and removing the part from contact with the grinding wheel while this dressing is going on.

3. A method as recited in claim 2, and further wherein the part is brought into contact with the grinding wheel after this dressing step has been completed.

4. A method as recited in claim 1, and further wherein the grinding wheel is periodically dressed during a grinding operation in order to ensure a desired surface shape on the wheel.

5. A grinding apparatus comprising:

a fixed base;

a grinding wheel mounted on said base and driven for rotation on a first axis;

a main body mounted laterally spaced from said wheel;

a part holder rotatably mounted within said main body;

a motor for rotating said part holder within said main body;

means for positioning said part holder such that a part mounted in said part holder will be in contact with said grinding wheel; and

means for moving said part holder along said grinding wheel through a plane perpendicular to said first axis while said motor is inoperative to create a flat surface on said part.

6. A grinding apparatus as recited in claim 5 and further wherein said means for positioning said part holder include a lateral motor for moving said main body laterally with respect to said grinding wheel and a horizontal motor for moving said main body horizontally with respect to said grinding wheel.

7. A grinding apparatus as recited in claim 6 and further wherein said lateral motor is a rotary-to-reciprocating motor.

8. A grinding apparatus as recited in claim 5 and further wherein said means for moving said part holder include a vertical motor for moving said main body vertically with respect to said grinding wheel.

9. A grinding apparatus as recited in claim 8 and further wherein said vertical motor includes a rotary-to-reciprocating motor.

10. A grinding apparatus as recited in claim 5 and further comprising biasing means biasing said part holder laterally toward said wheel, a seizure or the like causing a force in opposition to said biasing means that will move the part holder away from the wheel and relieve the seizure.

11. A grinding apparatus as recited in claim 5 and further comprising means for maintaining a desired surface on said wheel, said means for maintaining a desired surface including a dresser apparatus.

12. A grinding apparatus as recited in claim 11 and further wherein said dresser apparatus includes a diamond-tipped needle, a first motor selectively moving said diamond-tipped needle towards and away from said grinding wheel, a second motor moving said dresser apparatus horizontally with respect to said grinding wheel.

13. A grinding apparatus as recited in claim 12 and further wherein said diamond-tipped needle is moved into said grinding wheel to create a desired surface upon said grinding wheel, a control means controlling said motors of said dresser apparatus to cause said diamond-tipped needle to form the desired surface on said grinding wheel, said motor for moving said diamond-tipped needle into and away from said grinding wheel includes a rotary-to-reciprocating motor, said dresser apparatus having a flange and said grinding wheel having a notch that slidably receives said flanges to ensure proper positioning.

14. A grinding apparatus as recited in claim 11 and further comprising biasing means biasing at least said part holder laterally toward said wheel.

15. A grinding apparatus as recited in claim 14 and further wherein said biasing means is pressurized air.

16. A grinding apparatus as recited in claim 5 and further wherein said motor for rotating said part holder within said main body consists of a rotary motor mounted to a portion of said main body, said rotary motor rotating a shaft, said shaft having a belt operably connected so as to rotate said part holder.

17. A grinding apparatus as recited in claim 5 and further wherein:

said means for positioning said part holder include a lateral motor for moving said main body laterally with respect to said grinding wheel and a horizontal motor for moving said main body horizontally with respect to said grinding wheel;

said lateral motor consisting of a rotary motor rotating a shaft, said shaft having a screw thread formed at a first axial extent thereof;

said screw thread being received within an abutment member;

said abutment being prevented from rotating along with said shaft;

rotation of said screw thread of said shaft within said abutment causing said abutment to be reciprocated;

a portion of said main body being normally in contact with said abutment;

reciprocation of said abutment away from said grinding wheel causing said main body to move along therewith laterally away from said grinding wheel; and

said means for positioning further comprising a biasing means consisting of an air cylinder having a high-pressure air source connected thereto, said high-pressure air source causing pressurized air to impinge upon a piston, said piston being connected to said main body, the connection of high-pressure air to said piston causing said main body to move in a direction towards said grinding wheel, no mechanical connection existing between said abutment and said main body thus allowing said biasing means to be the sole force holding said main body in contact with said grinding wheel, a seizure or the like causing an abnormally large force upon said main body will overcome said biasing means and allow said main body to move laterally away from said grinding wheel.

18. A grinding apparatus as recited in claim 5 and further wherein:

said main body consisting of an inner body and an outer body portion;

said means for positioning said part holder including means for laterally moving said main body and means for horizontally moving said main body; and

said means for laterally and horizontally moving said main body moving both said inner and outer body portions of said main body, said means for moving said part holder such that a part is moved along said grinding wheel consisting of means for moving said part holder vertically with respect to said grinding wheel, said means for moving said part holder vertically only moving said inner body portion vertically with respect to said grinding wheel.

19. A grinding apparatus comprising:

a fixed base;

a grinding wheel mounted on said fixed base and driven for rotation on a first axis;

a dresser apparatus for maintaining a desired surface on said grinding wheel, said dresser apparatus including a diamond-tipped needle, said diamond-tipped needle being driven by a first motor into and away from said grinding wheel in order to cut a desired surface into the face of said grinding wheel, said diamond-tipped needle being driven horizontally with respect to said grinding wheel to allow said diamond-tipped needle to cut the desired surface along the entire face of said grinding wheel, said diamond-tipped needle being moved into and away from said grinding wheel by a rotary-to-reciprocating motor;

a main grinding wheel mounted laterally spaced from said body, biasing means biasing said body laterally towards said grinding wheel, said biasing means including high-pressure gas;

a part holder rotatably mounted within said body, said part holder having alignment means for ensuring that a part to be ground is accurately positioned therein;

a motor mounted within said body for rotating said part holder;

means for positioning said part holder such that a part to be ground mounted therein will be in contact with said grinding wheel, said means for positioning including a lateral motor and a horizontal motor, said lateral and horizontal motors being pneumatic motors having pistons and piston chambers; and

means for moving said part holder such that a part mounted therein is moved vertically along said grinding wheel to create a flat surface on said part to be ground, said means for moving including a rotary-to-reciprocating motor for moving said body and said associated part holder directly vertically upwardly, said motor for rotating said part holder being disengaged while said vertical movement is being performed.

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